Connective Tissue: Macromolecular Structure and Evolution

by M. B. Mathews
Springer-Verlag; Berlin, Heidelberg, New York, 1975
xii + 318 pages. DM 78.00; $ 34.00

In a recent paper [1] Scott points out that, with the evolution of single cells into multicellular organisms and then into higher animals, there arises the need for some kind of supporting or connecting medium. Thus this evolution is also the process of evolution of connective tissue. In its most primitive form this connecting medium would offer a measure of protection from the outside world, while allowing the inflow and outflow of nutrients essential to life. Further development will lead to an adaptation to mechanical stresses and with the maintenance of shape, so that in the higher animals the connective tissue assumes an extraordinary range of structure and functions, ranging from the transparent cornea to the rope-like tendon and including calcified tissues such as bones and teeth, tubular structures such as blood vessels, membranes such as the glomerular basement membrane, gels such as the vitreous humor of the eye, stress-resisting structures such as cartilage, and elastic structures such as ligaments. Yet the framework in which this evolution has taken place is really quite simple, and is based on a fibrous meshwork embedded in a soluble polymer which is predominantly carbohydrate and polyanionic in nature.

This book documents these items with a wealth of data and a wide range of topics, which is impressive when one considers that it is the work of one author. There are separate chapters on the major macromolecular components collagen (chapter 3), elastin (chapter 4), structural glycoproteins (chapter 5) and proteoglycans (chapter 6). Each chapter follows a similar pattern, dealing with structure including a comparison of the phyla from invertebrate through to the vertebrates, biosynthesis and a section on the molecular evolution of the macromolecules. By far the largest and most detailed chapter is that on the proteoglycans, reflecting, perhaps inevitably, the author's own major research interest.

Chapter 7 is also concerned with the proteoglycans but more specifically with that of cartilage, bone and notochord and with the glycan component of these polyanions. Here, as elsewhere, emphasis is placed on comparative studies between phyla and between tissues. Chapter 8 deals in a similar way with the polyanionic glycans in development and aging of vertebrate cartilage, and chapter 9 with the same components in other tissues in both vertebrates and invertebrates. In chapter 10 an attempt is made to relate our knowledge of the connective tissue macromolecule in terms of interactions between them which give rise to an hierarchy of organisational levels. By changing the proportions of fibres and soluble polymers, or by altering the spatial relationship between the two, quite different structures and functions can result, and this is brought out in a final short chapter.

The references in these chapters are reasonably up to date, and newer work up to 1974 is discussed in an addendum to each chapter. The detailed data is compiled and tabulated in a way which allows easy reference and it is as a reference book that many will use it.

The photo-offset presentation, used probably to ensure reasonably rapid publication, is not the most felicitous, but the text is free of typographical errors. There is a useful index, but the few illustrations which are mostly line diagrams could, with profit, have been of better quality.

This reviewer did not find it easy reading, partly because of a certain turgidity of the prose, and partly because of the detailed enumeration of facts and the compilations of comparative data, but it is well worth the effort.

[1] Scott, J. E. (1975) Phil. Trans. R. Soc. Lond. B 271, 235–242.

D. S. Jackson